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CONTENTS OF No. 106.

	PAGE
The Morality of Happiness. By Thomas Foster	283
The Sun's Distance. By Professor R. S. Ball, LL.D.	284
The Chemistry of Cookery. XXII. By W. Mattieu Williams	285
Mathematics of the Imaginary. By Richard A. Proctor	287
Richter's Dream	288
The Ring of Small Planets. By R. A. Proctor	290
Editorial Gossip	292
The Face of the Sky. By F.R.A.S.	292
Correspondence: The Green Sun in India—A Curious Phenomenon—Brilliant Rainbow—New Moon on Saturday: Day of Week—Mud-Guards for Tricycles—Chestnuts and Beechmast—Total Abstinence—Internal Parasites, &c.	293
Our Whist Column	295
Our Chess Column	296

THE MORALITY OF HAPPINESS.

BY THOMAS FOSTER.

(*Continued from page* 254.)

THERE is only one way of escape from the conclusion reached in our last,—that conduct is good or bad according as its total effect are pleasurable or painful,—in which statement be it understood the word total *means* total and is not limited in its application to the person whose conduct is spoken of. If it is supposed that men were created to suffer, that a power which they were bound to obey had planned such suffering, so that any attempt either to take pleasure or to avoid pain was an offence, then of course the conclusion indicated is an erroneous one.

No system of religion has ever definitely taught so hideous a doctrine. Even where sorrow and suffering are recognised as the lot of man, and even where self-inflicted anguish and misery are enjoined as suitable ways of pleasing Deity, it is never said that such sufferings are the ultimate desire of the Supreme Power. These tribulations are all intended for our good: we are to torture ourselves here and now that hereafter we may avoid much greater pains or enjoy much greater pleasures than here and now we could possibly experience.

Yet underlying this doctrine of greater and longer-lasting happiness as the result of temporary suffering or privation, there has been and is in many so-called religions the doctrine that pain and suffering are pleasing to the gods of inferior creeds and even to the Supreme Power of higher beliefs. The offerings made systematically by some races to their deities imply obviously the belief that the gods are pleased when men deprive themselves of something more or less valued. Sacrifices involving slaughter, whether of domestic animals or of human beings, mean more, for they imply that suffering and death are essentially pleasing to deity. Even when such gross ideas are removed and religion has been purified, the symbolisation of sacrifice in most cases takes the place of sacrifice itself. The conception may and often does remain as an actually vital part of religious doctrine that pleasure is offensive to the Supreme Power and pain pleasing.

If this conception is really recognised and any men definitely hold that to enjoy or to give pleasure is sinful, because displeasing to God, while the suffering or infliction of pain is commendable, then for them—but for them only—the doctrine is not established that conduct is good or bad according as its total effects are pleasurable or painful. But if there are such men, then they are mentally and morally the direct descendants of the savage of most brutal type, who because he himself delights to inflict pain deems his gods to be of kindred nature and immolates victims to them (or if necessary to gain his ends, shows the reality of his belief by self-torture) to obtain their assistance against his enemies.

If there are such men among us still, then as Mr. Herbert Spencer says, "we can only recognise the fact that devil-worshippers are not yet extinct." The generality of our conclusions is no more affected by such exceptions as these than it is by the ideas which prevail in Bedlam or Earlswood.

But on the one hand the doctrine thus reached may be passed over as a truism (which it ought to be and indeed is, though like many truisms, unrecognised); and on the other it may be scouted as Epicurean (which is unmeaning nonsense, however) and as mere pig-philosophy. For it sets happiness as the aim of conduct, and whether self-happiness or the happiness of others is in question, many find in the mere idea of pleasure as a motive for conduct something unworthy,—thereby unconsciously adopting the religious doctrine which has been justly compared with devil-worship.

This expression — Pig-philosophy — has indeed been applied to the doctrine we are considering, by a philosopher who, with Mr. Ruskin and Mr. Matthew Arnold, may be regarded as chief among the wonders of our age—and standing proof of the charm which the British race finds in Constant Grunt, Continual Growl, and Chronic Groan. It must be considered, therefore, as certain that to some minds a philosophy which sets the happiness of self and others as a worthy end, must appear unworthy. Such minds find something pig-like in the desire to see the happiness of the world increased. Yet grunting and groaning are at least as characteristic of the porcine race as any desire to increase the comfort of their fellow-creatures or even their own. Mr. Herbert Spencer's lightsome pleasure-doctrine, the essence of which is that we should strive to diminish pain and sorrow (our own included) and to increase joy and happiness, is less suggestive of porcine ways (at least to those who have noted what such ways are) than—for instance—the following cheerful address to Man, "Despicable biped! what is the sum total of the worst that lies before thee? Death? Well, Death; and say the pangs of Tophet, too, and all that the Devil and Man may, will, or can do against thee! Hast thou not a heart; canst thou not suffer whatsoever it be; and, as a Child of Freedom, though outcast, trample Tophet itself under thy feet, while it consumes thee?" Were this but stern resolution to endure patiently, and even cheerfully such sorrows as befall man, it were well. Nay it would fall in with the philosophy of happiness, which enjoins that for their own sake as for the sake of those around them men should bear as lightly as they may their burden of inevitable sorrow. But what Carlyle calls the New-birth or Baphometic Fire-baptism is not Patience but Indignation and Defiance. This is the veritable Pig-philosophy: the "Everlasting No" (*das ewige Nein*) is in truth the Everlasting Grunt of dyspeptic disgust, the constant Oh-Goroo-Goroo of a jaundiced soul.

Are the teachings of living professors of the Everlasting Groan school brighter than those of the gloomy Scotsman? Here are some of the latest utterings of the chief among

them—"Loss of life!" exclaims Mr. Ruskin, cheerfully. "By the ship overwhelmed in the river, shattered on the sea; by the mine's blast, the earthquake's burial—you mourn for the multitude slain. You cheer the lifeboat's crew; you hear with praise and joy the rescue of one still breathing body more at the pit's mouth; and all the while, for one soul that is saved from the momentary passing away (according to your creed to be with its God), the lost souls yet locked in their polluted flesh, haunt, with worse than ghosts, the shadows of your churches and the corners of your streets; and your weary children watch, with no memory of Jerusalem, and no hope of return from *their* captivity, the weltering to the sea of your Waters of Babylon." *Oh! Goroo! Gorooo-oo!*

Any philosophy which hopes for other than misery and disgust in life, must indeed seem strange doctrine to teachers such as these,—even as the smiles of the cheerful seem unmeaning and offensive to those whose souls are overcast with gloom and discontent. Sir Walter Scott tells a story of his childhood which well illustrates the unreasoning hatred felt by the Everlasting Growl school for the doctrine that conduct should be directed to the increase of happiness. One day, his healthy young appetite made him enjoy very heartily the brose or porridge of the family breakfast. Unluckily he was tempted to say aloud how good he found his food. His father at once ordered a pint of cold water to be thrown in, to spoil the taste of it! Possibly he meant to inculcate what he regarded as a high moral habit; but rather more probably Mr. Walter Scott, sen., objected to his son's enjoying what he had no taste for himself. Much of the sourness of the Growl Philosophy may be thus interpreted.

(*To be continued.*)

THE SUN'S DISTANCE.*

By Professor R. S. Ball, LL.D.,

Astronomer-Royal for Ireland.

(*Continued from page* 257.)

THE most celebrated method of measuring the distance from the earth to the sun is without doubt that which is afforded by the transit of Venus. This has engrossed more than all the other methods together. On four occasions the attempt has been made to find the sun's distance by its aid; the last of these occurred only last December, and another opportunity will not occur until June in 2,004. It was formerly supposed, and it is, no doubt, still maintained by many, that the transit of Venus is *par excellence* the method, but the growth of practical astronomy has tended to question the supremacy of the transit of Venus. An attack has been made in two distinct directions. It has on the one hand been shown that the transit of Venus is incapable of the accuracy that was at one time claimed for it. On the other hand the new method by the aid of the minor planets has arisen.

The recent transit of Venus was observed in this country. It was on December 6 last, late in the afternoon, that the memorable event took place. The weather, it may be remembered, was in most places very unfavourable. A heavy snowstorm prevailed over a great part of the country. At Dunsink Observatory, Dublin, where I reside, a more unfavourable morning could not well have been conceived. The snow was falling, the clouds were thick, and there did not seem to be the slightest chance that anything could be seen. The day before was tolerably fine, and we had a sort of rehearsal of the observations to be made. The large equatorial was directed to the sun, and it was followed to the horizon. As the sunset approached the sun passed behind a tree and could not be seen. This was one use of the rehearsal; it showed that the tree was an obstacle. I pointed this out to the kind neighbour in whose grounds the tree was placed, and next morning the top was cut off.

On the eventful day, and up to about half-an-hour before the commencement, there did not seem to be a chance that any observations would be obtained, but we placed everything in readiness as if the day had been perfect. Just before the critical moment the snow ceased, the clouds began to break, and though the commencement was missed, I enjoyed a beautiful glimpse of the planet when its disc had about half entered on the face of the sun. It was, however, but little more than a glimpse, for the clouds again gathered and the snow descended, giving me for a few moments an exquisitely beautiful telescopic picture of a snowstorm, with the sun's disc as a background. For an hour nothing could be seen. Then again the clouds opened and disclosed what I can only describe as a most beautiful and striking picture. The sun had commenced to put on the ruddy hues of sunset. Its disc was streaked with bands of clouds, and far in on the surface hung the dark body of the planet. It was one of those rare sights which once seen can never be forgotten.

Good fortune has generally attended the expeditions which last December were scattered far and wide over the earth to observe the transit of Venus. A map is prepared to indicate the various regions in which the different phases of the transit were visible. The British Isles are seen just to fall into the region in which the commencement of the transit is visible. In the eastern parts of Europe and the whole of Asia the entire is invisible. The western hemisphere contains more favoured regions. The most glorious views of the transit of Venus were those obtained in America. In the centre of the region where the whole transit is visible lies the splendid empire of Brazil. The only part of the American continent which was unfavourably situated was the British possessions at the North.

We cannot now enter into details as to the method by which the transit of Venus is used for the purpose of finding the sun's distance. Every book on astronomy contains a description of the process. It will be my duty to attempt to define the amount of accuracy of which the method is capable. The observations to be employed are chiefly those made when the planet and the sun are apparently in contact, and the value of the method mainly depends on the possibility of determining the time with precision at which the contact takes place.

It was at one time believed that exceptional accuracy was attainable in such observations. Experience has not shown that these expectations were well founded. Look, for example, at a photograph of the drawings made on the last occasion by one of the most skilful observers, Dr. Vogel. We have here six most beautiful views of the progress of Venus as it approached to the first internal contact. The two extreme observations are plain enough. At 3 h. 10·8 min. Venus had not entered on the face of the sun completely. At 3 h. 14·1 min. there can be no doubt that the critical moment had passed. There are four intermediate stages. The recorded time of contact is 3 h. 13 min. 15 sec., but there must be a latitude of many seconds in the attempt to define a moment so confused.

The chief reason of the difficulty arises from the sluggish motion of Venus. The problem is something like trying

* A discourse delivered at the second general meeting of the British Association at Southport.

to tell the time accurately on a watch which had no minute hand; but besides the difficulty from this cause there are other difficulties of a very special character. Venus is surrounded by an atmosphere. You see the atmosphere in the ring of light surrounding the planet in Vogel's picture. The sun's rays are refracted through this atmosphere, and they place the observer in a condition of very great embarrassment, for the edge of the sun is distorted at the moment of contact.

Another source of difficulty arises from the phenomenon known as irradiation. Venus is a black spot; the sun is of dazzling brilliancy. This contrast has the effect of making Venus smaller than it ought to appear. A white circle on a black ground appears to be larger than a black circle on a white ground, even though both may really be exactly the same size. The irregularities arising from this cause affect in a marked degree the observations of the transit of Venus. The difficulties may, to a certain extent, be removed by calling in the aid of photography. By photography, also, a large number of observations can be secured during the progress of the transit, and thus in some degree compensation is made for the rare occurrence of the phenomenon.

A grand effort has certainly been made by the British Government, under the skilful direction of Mr. Stone, to give the transit of Venus a fair trial. Expeditions were sent to the West Indies, to South Africa and Madagascar, to Australia, and to New Zealand. The expeditions were, on the whole, very fortunate so far as the weather was concerned, and no doubt an approximate value of the sun's distance will be the result. I do not, however, believe that the transit of Venus can be expected to give that distance accurately to one-thousandth part. It is impossible to define the contacts with the precision that would be required.

Asking and Answering.—Correspondents who are so kind as to interrogate me as to the origin of the expressions, "Cleanliness is next to Godliness," "A Skeleton in the Cupboard," "Pouring Oil on the Troubled Waters," "He has burnt his Bridges," and the like, are respectfully referred—(1) to Mr. Wheeler's "Familiar Allusions"; (2) to Dr. Cobham Brewer's "Dictionary of Phrase and Fable"; (3) to the same learned author's "Reader's Handbook"; (4) to Mr. Eliezer Edwards's "Words, Facts, and Phrases"; and, finally, to *Notes and Queries*. I have repeatedly hinted to my readers that my main business here below is to keep out of St. Pancras Workhouse; and to that Haven of Rest I should speedily be bound if I tried to answer even a twentieth part of the questions asked me, and which (my early education having been sadly neglected) I am wholly unable to solve.—G. A. Sala in the *Illustrated London News*.

The Telephones of the World.—According to a German statistical periodical, in the year 1882 telephones were in use in the whole world in 303 towns, the subscribers numbering 78,808. This number is divided as follows:—Europe, 161 towns with 30,066 subscribers; America, 126 towns, with 47,185; Asia, 7 towns, with 420; Australia, 5 towns, with 897; and Africa, 4 towns, with 240. The European towns having telephones are divided as follows among the different countries:—Great Britain, 75 towns, with 7,287 subscribers; Germany, 21 towns, and 3,613 subscribers; France, 18 towns, and 4,437 subscribers; and Italy, 13 towns, and 5,507 subscribers. There is, therefore, an average of 424 subscribers for every town in Italy, 247 in France, 172 in Germany, and only 97 in Great Britain. The United States has 112 towns with telephone stations, and 41,569 subscribers.

THE CHEMISTRY OF COOKERY.

By W. Mattieu Williams.

XXII.

I NOW come to a very important constituent of animal food, although it is not contained in beef, mutton, pork, poultry, game, fish, or any other organised animal substance. It is not even proved satisfactorily to exist in the blood, although it is somehow obtained from the blood by special glands at certain periods. I refer to *casein*, the substantial basis of cheese, which, as everybody knows, is the consolidated curd of milk.

It is evident at once that casein must exist in two forms, the soluble and insoluble, so far as the common solvent, water, is concerned. It exists in the soluble form, and completely dissolved in milk, and insoluble in cheese. When precipitated in its insoluble or coagulated form as the curd of new milk it carries with it the fatty matter, or cream, and therefore, in order to study its properties in a state of purity, we must obtain it otherwise. This may be done by allowing the fat globules of the milk to float to the surface, and then remove them—*i.e.*, by separating the cream as by the ordinary dairy method. We thus obtain in the skimmed milk a solution of casein, but there still remains some of the fat. This may be removed by evaporating it down to solidity, and then dissolving out the fat by means of ether, which leaves the soluble casein behind. The adhering ether being evaporated, we have a fairly pure specimen of casein in its original or soluble form.

This, when dry, is an amber-coloured translucent substance, devoid of odour, and insipid. This insipidity and absence of odour of the pure and separated casein is noteworthy, as it is evidently the condition in which it exists in milk, but very different from that of the casein of cheese. My object in pointing this out is to show that in the course of the manufacture of cheese new properties are developed. Skim milk—a solution of casein—is tasteless and inodorous, while cheese, whether made from skimmed or whole milk, has a very decided flavour and odour.

If we now add some of our dry casein to water, it dissolves, forming a yellowish viscid fluid, which, on evaporation, becomes covered with a slight film of insoluble casein, which may be readily drawn off. Some of my readers will recognise in this description the resemblance of a now well-known domestic preparation of soluble casein, condensed milk, where it is mixed with much cream, and in the ordinary preparation also much sugar. The cream dilutes the yellowness, but does not quite mask it, and the viscidity is shown by the strings which follow the spoon when a spoonful is lifted. If a concentrated solution of pure casein is exposed to the air it rapidly putrefies, and passes through a series of changes that I must not tarry to describe, beyond stating that ammonia is given off, and some crystalline substances, such as *leucine*, *tyrosine*, &c., very interesting to the physiological chemist, but not important in the kitchen, are formed.

A solution of casein in water is not coagulated by boiling; it may be repeatedly evaporated to dryness and redissolved. Upon this depends the practicability of preserving milk by evaporating it down, or "condensing." This condensed milk, however, loses a little; its albumen is sacrificed, as everybody will understand who has dipped a spoon in freshly-boiled milk and observed the skin which the spoon removes from the surface. This is coagulated albumen.

If alcohol is added to a concentrated solution of casein in water, a pseudo-coagulation occurs; the casein is precipitated as a white substance like coagulated albumen, but if only a little alcohol is used, the solid may be redissolved

in water; if, however, it is thus treated with strong alcohol, the casein becomes difficult of solution, or even quite insoluble. Alcohol added to solid soluble casein renders it opaque, and gives it the appearance of coagulated albumen. The alcohol itself dissolves a little of this.

The characteristic coagulation of casein, or its conversion from the soluble to the insoluble form, is produced rather mysteriously by rennet. Acids precipitate it from an aqueous solution, producing an apparent coagulation, but it is not a true and complete coagulation like that effected by the rennet, for on neutralising the acid precipitant with an alkali or metallic oxide the casein again dissolves. Excepting in the cases of acetic and lactic acids (vinegar and the acid of sour milk), which precipitate pure casein, the acid precipitates appear to be a compound of casein with the acids, and the casein is set free in its original state when the acid goes over to the alkali or basic metallic oxide. The action of rennet in the coagulation of casein is still a chemical mystery, especially when we consider the smallness of the quantity of coagulating agent required for the rapid and complete conversion.

A calf has four stomachs, the fourth being that which corresponds to ours, both in structure and functions. It is lined with a membrane from which is secreted the gastric juice and other fluids concerned in effecting the conversion of food into chyme. A weak infusion made from a small piece of this "mucous membrane" will coagulate the casein of two or three thousand times its own quantity of milk, or the coagulation may be effected by placing a small piece of the stomach (usually salted and dried for the purpose) in the milk, and warming it for a few hours.

Many theoretical attempts have been made to explain this action of the rennet. Simon and Liebig supposed that it acts primarily as a ferment, converting the sugar of milk into lactic acid, and that this lactic acid coagulates the casein; but Selmi has shown that alkaline milk may be coagulated by rennet in the course of ten minutes, and that after the coagulation it still has an alkaline reaction. This is the case whether fresh naturally alkaline milk is used, or milk that has been artificially rendered alkaline by the addition of soda.

Casein, when thoroughly coagulated by rennet, then purified and dried, is a hard and yellowish horn-like substance. It softens and swells in water, but does not dissolve therein, nor in alcohol nor weak acids. Strong mineral acids decompose it. Alkalies dissolve it readily, and, if concentrated, decompose it on the application of heat. When moderately heated, it softens and may be drawn into threads, and becomes elastic; at a higher temperature it fuses, swells up, carbonises, and develops nearly the same products of distillation as the other protein compounds.

I have good and sufficient reasons for thus specifying the properties of this constituent of food. I regard it as the most important of all that I have to describe in connection with my subject — the science of cookery. It contains (as I shall presently show) more nutritious material than any other food that is ordinarily obtainable, and its cookery is singularly neglected, is practically an unknown art, especially in this country. We commonly eat it raw, although in its raw state it is peculiarly indigestible, and in the only cooked form familiarly known among us here, that of a Welsh rabbit, or rarebit, it is too often rendered still more indigestible, though this need not be the case.

Here, in this densely populated country, where we import so much of our food, cheese demands our most profound attention. The difficulties and cost of importing all kinds of meat, fish, and poultry are great, while cheese may be cheaply and deliberately brought to us from any part of the world where cows or goats can be fed, and it can be stored more readily and kept longer than other kinds of animal food. All that is required to render it, next to bread, the staple food of Britons is scientific cookery.

If I shall be able, in what is to follow, to impart to my fellow-countrymen, and more especially countrywomen, my own convictions concerning the cookability, and consequent improved digestibility, of cheese, these papers will have "done the State some service!"

A CORRESPONDENT sends from the "Casket of Literary Gems," Horace Smith's "Astronomical Alderman." The following lines may amuse some of our readers who have not seen the original.

Then he began with mighty bonhomie
To talk astronomy.
"Sir," he exclaim'd between his bumpers,
"Copernicus and Tycho Brahe,
And all those chaps have had their day;
They 've written monstrous lies, sir,—thumpers!
Move round the sun?—it's talking treason;
The earth stands still—it stands to reason.
Round as a globe?—stuff—humbug—fable!
It's a flat sphere, like this here table,
And the sun overhangs this sphere,
Ay—just like that there chandelier."
"But," quoth his neighbour, "when the sun
From East to West his course has run,
How comes it that he shows his face
Next morning in his former place?"
"Ho! there's a pretty question, truly!"
Replied our wight with an unruly
Burst of laughter and delight,
So much his triumph seem'd to please him;
"Why, blockhead, he goes back at night,
And that 's the reason no one sees him."

TRUTH STRANGER THAN FICTION.—A good joke is often spoilt by dwelling too long upon preliminaries, and we shall therefore avoid discursiveness. In these days of school-boards and science departments, of examinations and certificates, it is hard to realise the following:—The Electrical Power and Storage Company had occasion recently to lend a secondary battery charged and ready for use. For the carriage the railway authorities claimed 22s. 6d. The battery was used and returned, the railway authorities now claiming 17s. 6d. A remonstrance was made as to the excess of charge in one direction over that in the other, which was met by the reply: Oh! but the cells were fully charged going, and returned empty, hence the difference in the carriage.—*Electrician.*

TROUVÉ'S RHEOSTAT.—A very useful rheostat has been devised by M. Trouvé, the well-known Parisian inventor. It consists of a German silver spring enclosed in a nickel-plated tube, the spirals not being allowed to touch each other, and insulated from the tube by a pasteboard sheathing. Inside the spring is a rubbing contact formed of a metal rod split into four parts, like the split plugs of a resistance box. This rod is graduated in divisions. The current enters at one end of the spring, traverses it, the rubbing contact, and the graduated rod. When the rod is deeply inserted into the spiral coil, the current only traverses a few turns, and the resistance in circuit is very small; but when the rod is pulled out, the number of turns inserted is considerable. The divisions on the scale tell the number of turns in circuit. The device is employed by Trouvé in connection with his polyscopes to regulate the strength of current supplied by a small Planté accumulator. The plan of splitting the rubbing contact is worthy of attention by electricians.—*Engineering.*

MATHEMATICS OF THE IMAGINARY.

By Richard A. Proctor.

PROFESSOR CAYLEY, President of the British Association, has delivered to that body (for the first time in its history) an address devoted entirely to mathematics—first with regard to the development of the mathematical theories by which science has been advanced, secondly (and principally) with reference to the strange fancies about imaginary geometries and space of more than three dimensions on which some of the ablest mathematicians of our time have squandered their powers. Certain journals, not too celebrated for profundity, but rather known for the stupendous blunders about scientific matters into which they have occasionally fallen, find much to commend in the profundity of Professor Cayley's address. The British Association was established, they tell us, for the advancement, not for the popularisation of science, and therefore the mere fact that out of 2,000 persons who collected to hear Cayley's opening address not a hundred even knew what he was talking about, and of these not ten could follow his semi-metaphysical semi-transcendental reasoning, was not open to exception. Just here, without considering the very doubtful question, or rather the question not open to any sort of doubt, whether discussions about non-Euclidian geometry and dimensions outside length, breadth, and thickness, in space, tend very greatly to the advancement of science, I may note that whatever the purpose of the British Association itself, the annual meetings of the Association have for their object, distinctly and emphatically, the popularisation of science. They even cater for this object in ways which are little consistent in my opinion with the dignity of science. Excursions are good things in their way, but they certainly do not tend in any marked degree (at least as arranged by the authorities of the British Association) to advance scientific research. Evening assemblies, in which the local folk, mayor, aldermen, and common councilmen, with their wives and mothers, sisters, cousins and aunts, form a motley gathering, in company with professors and their kinsfolk, and many by no means scientific representatives of fogeydom, are not calculated to excite a very profound feeling of respect for science.

No one who has attended meetings of the British Association can have failed to notice how large a proportion of the Members and Associates know scarce anything about science. For such folk certainly a discourse on imaginary points in space was wanting in interest, to say the least. For my own part, I think all such discussions not only wanting in value, but mischievous. All the powers of mathematics as now developed, and as ever likely to be developed, are insufficient for the work we want mathematics to do for science; and yet some of the ablest professors of mathematics are not ashamed to waste their energies in mere dreaming, and wild and foolish dreaming at that.

What, after all, do these notions about non-Euclidian geometry and a fourth dimension in space, amount to? In mathematics we deal with conceptions, more or less illustrated by things within our experience and subject to observation. All our conceptions, and all our experiences so far as they can be pushed, agree in presenting certain doctrines to us as axiomatic. It is not supposed, nor even regarded as conceivable, by the mathematicians of the new school, that our conceptions respecting mathematical axioms will ever change, or our experiences be ever corrected by others inconsistent with these conceptions. Straight lines which diverge from a point we never can conceive as converging again, without losing their straightness, after reaching a certain remoteness from a point of divergence. Nor can we suppose or even imagine ("which is else") that were we only able to carry on two such lines far enough we should find—say somewhere about a billion times the distance of the remotest star seen by the great Rosse telescope—divergence beginning to be transformed into convergence. So of other axiomatic properties. We cannot conceive a fourth dimension in space besides length and breadth and depth: if we take any plane whatever in which to measure length and breadth, we cannot conceive that plane, while remaining plane, to fail to divide all space into two portions, one on one side of it the other on the other, and this being so we cannot conceive any point as existing outside the plane which has not a certain distance from the plane, a distance which we may call depth or height as the case may be. It would be absolutely essential to our conception of a fourth dimension in space that we *should* be able to conceive of such points. Go to, then, say the mathematicians of the fancifully useless school, since we cannot conceive diverging lines as meeting again let us *pretend* we can conceive them so doing, and make a new geometry based on such a conception (as Lobatschewsky has done); and since we cannot conceive a fourth dimension in space let us act as though we could, and try to find what would be the order of things in universes of four, five, six, or n dimensions. So long as we measure as we do measure, and conceive perfect measurement as simply the kind of measurement which we aim at but cannot attain, our geometry is such as Euclid and his fellows have dealt with. Let us therefore imagine another and entirely different state of things,—let us pretend that every measuring line we use varies in length according to the place in space where it is used, increasing it may be towards some central point where it becomes absolutely infinite though it was finite where we began to use it, or instead diminishing down to nothing at the centre, though it was originally not to be distinguished from a respectable foot-rule. Or instead suppose it of a certain definite length at the centre, but either increasing to infinity or diminishing to nothing at some given distance from the centre.

The folly of all this is manifest enough. It may suit mathematicians of a certain school to suppose that by talking about the inconceivable as if they could grasp and understand it, they convince the world of their profundity. But the world is not altogether wanting in common sense, not ready to sing in chorus about the professors of the unintelligible—

> If that will not suit them which will very well suit "we,"
> Why what very very wise wise men these wise wise men must be.

But is is not altogether upon the unwisdom of inconceivable mathematics that I would comment. There is a more serious aspect of the matter. Science wants for her advancement the assistance of all who are competent to work well in her service. In mathematical research, especially, science needs the help of every one of the few who can really advance our knowledge in that direction. Science, then, has just reason to be angry when those who are best able to assist in the development of mathematics waste their time and squander their power in attempting to discover what would be the state of things in a world where all things were unlike what we know and can alone conceive,—where things equal to the same thing were not equal to each other, where two and two made three or five, where two straight lines might enclose a space or many spaces, where lines and curves not intersecting in *our* world might have imaginary points of intersection, and where finally besides length and breadth and depth there might

be a fourth, or fifth, or sixth, or *n*th dimension. So long as their existence is past in the world we know of and not in the "limbo of imaginary intersections" of which they love to speak, our mathematicians might condescend to do what Newton, Lagrange and Laplace, Euler, Adams, Leverrier, and Delaunay, have done with zeal and fervour,—viz., to advance, as far as in them lies, the mathematics of actual relations. To do this well will tax all their powers.

LEAD-SMELTING IN CYPRUS.—The Cypriot peasant, when in pursuit of mouflon, the wild sheep of the island, makes the slugs for his flint-gun in the forest in the following primitive manner:—He takes two solid pieces of the bark of *pinus maritimus*, one about 18 in. long and 4 in. wide, the other much smaller. In the first he cuts a straight groove, a foot long, and just large enough to hold a cedar pencil. This is his mould, which he places horizontally on the ground by filling the groove with water, and then propping the bark with stones until the water is level. The water he then throws away. In the smaller piece of bark he scoops out a round hole, about 3 in. across and an inch deep. This is his smelting-pot, or furnace, and he cuts a slot from the cavity at one side to "run" the lead through. Into this cavity he puts some bits of red cinder from his wood fire. Over them he puts a few ounces of small shot, and this, again, he covers up with more of the red coals. Then using his mouth as a bellows, he blows vigorously upon the mass (all the Cypriot shepherds have splendid lungs) until, in a very short time, the shot is melted. He then pours it into the mould (which has had time to dry), and so produces a foot-long pencil of lead. This he rolls between two flat stones until it is quite even. Next he cuts it into short bits, which he again rolls, with a circular motion, between the stones, and thus obtains about forty slugs, or little bullets, nearly as perfectly round as the buckshot of commerce.

ALTHOUGH boring for coal has been carried out in several places in China, and working has been attempted in some of these, there is only one colliery at present in complete working order in the Celestial Empire. This is at Kaiping not far from Pekin, the colliery plant of which has been illustrated in our pages. The coal is said to belong to the true carboniferous system, and the bed dips to the south some 45 degs., forming a large basin under the Gulf of Pehchihli. No fear is entertained that the measures will run short. So far as has been ascertained, the coal-bearing stratum is about 1,000 ft., containing thirteen seams. During the winter months, 200 tons per day of the inferior kinds of coal can be sold to the natives in the vicinity, who use it for pottery, brick, and lime kilns; indeed, one of the most important results achieved by the opening of the colliery has been the revival of several industries in the vicinity which were languishing or extinct, on account of the surface coal of the district being mostly worked out, and the price of coal being too high to be used with profit. In connection with the colliery is a small railway, the only one in China. Its length is but six and a-half miles, and at the terminus the coal is placed in barges and carried down by canal. After a little opposition, the locomotives were allowed to run freely. But ironworks, which it was also intended to start, could not get over the superstitious opposition raised on the score of the proximity of the Imperial tombs, and the consequent geomantic disturbances caused by sinking shafts, &c. The iron ore is said to exist in enormous quantities, but it is not easy to work owing to the amount of silica present.—*Engineering.*

RICHTER'S DREAM.

I RECENTLY quoted De Quincey's version of Richter's Dream, as I am in the habit of reciting it at the close of my lectures on the "Star Depths" and on the "Birth and Death of Worlds." A correspondent has kindly sent me the following copy of De Quincey's translation of Richter's Dream (vol. 13), which is very different from the other, justifying fully, I think, the words with which I introduce Richter's Dream,—"as translated, or rather as transformed and purified by our own prose poet, De Quincey:—

DREAM UPON THE UNIVERSE.

I had been reading an excellent description of Krüger's upon the old vulgar error which regards the space from one earth and sun to another as empty. Our sun, together with all its planets, fills only the 31,419,460,000,000,000th part of the whole space between itself and the next solar body. Gracious heavens! thought I, in what an unfathomable abyss of emptiness were this universe swallowed up and lost, if all were void and utter vacuity except the few shining points of dust which we call a planetary system! To conceive of our earthly ocean as the abode of death, and essentially incapable of life, and of its populous islands as being no greater than snail-shells, would be a far less error in proportion to the compass of our planet than that which attributes emptiness to the great mundane spaces; and the error would be far less if the marine animals were to ascribe life and fulness exclusively to the sea, and to regard the atmospheric ocean above them as empty and untenanted. According to Herschel, the most remote of the galaxies which the telescope discovers lie at such a distance from us that their light, which reaches us at this day, must have set out on its journey two millions of years ago; and thus, by optical laws, it is possible that whole squadrons of the starry hosts may be now reaching us with their beams, which have themselves perished ages ago. Upon this scale of computation for the dimensions of the world, what heights and depths and breadths must there be in this universe—in comparison of which the positive universe would be itself a nihility were it crossed, pierced, and belted about by so illimitable a wilderness of nothing! But is it possible that any man can for a moment overlook those vast forces which must pervade these imaginary deserts with eternal surges of flux and reflux, to make the very paths to those distant starry coasts voyageable to our eyes? Can you lock up in a sun or in its planets their reciprocal forces of attraction? Does not the light stream through the immeasurable spaces between our earth and the nebula which is furthest removed from us? And in this stream of light there is as ample an existence of the positive, and as much a home for the abode of a spiritual world, as there is a dwelling-place for thy own spirit in the substance of the brain. To these and similar reflections succeeded the following dream:—

Methought my body sank down in ruins, and my inner form stepped out apparelled in light; and by my side there stood another form which resembled my own, except that it did not shine like mine, but lightened unceasingly. "Two thoughts," said the form, "are the wings with which I move: the thought of *Here* and the thought of *There*. And, behold! I am yonder," pointing to a distant world. "Come, then, and wait on me with thy thoughts and with thy flight, that I may show to thee the universe under a veil." And I flew along with the Form. In a moment our earth fell back, behind our consuming light, into an abyss of distance; a faint gleam only was reflected from the summit of the

Cordilleras, and a few moments more reduced the sun to a little star, and soon there remained nothing visible of our system except a comet, which was travelling from our sun with angelic speed in the direction of Sirius. Our flight now carried us so rapidly through the flocks of solar bodies—flocks past counting unless to their heavenly Shepherd—that scarcely could they expand themselves before us into the magnitude of moons, before they sank behind us into pale nebular gleams; and their planetary earths could not reveal themselves for a moment to the transcendent rapidity of our course. At length Sirius and all the brotherhood of our constellations and the galaxy of our heavens stood far below our feet as a little nebula amongst other yet more distant nebulæ. Thus we flew on through the starry wildernesses; one heaven after another unfurled its immeasurable banners before us, and then rolled up behind us; galaxy behind galaxy towered up into solemn altitudes before which the spirit shuddered; and they stood in long array through which the Infinite Being might pass in progress. Sometimes the form that lightened would out-fly my weary thoughts; and then it would be seen far off before me like a coruscation among the stars, till suddenly I thought again to myself the thoughts of *There*, and then I was at its side. But, as we were thus swallowed up by one abyss of stars after another, and the heavens above our eyes were not emptier; neither were the heavens below them fuller, and as suns without intermission fell into the solar ocean like water-spouts of a storm which fall into the ocean of waters; then at length the human heart within me was overburdened and weary and yearned after some narrow cell or quiet oratory in this metropolitan cathedral of the universe. And I said to the Form at my side, "Oh, Spirit! has then this universe no end?" and the Form answered, and said, "Lo! it has no beginning."

Suddenly, however, the heavens above us appeared to be emptied, and not a star was seen to twinkle in the mighty abyss; no gleam of light to break the unity of the infinite darkness. The starry hosts behind us had all contracted into an obscure nebula; and, at length, *that* also had vanished. And I thought to myself, "At last the universe has ended," and I trembled at the thought of the illimitable dungeon of pure, pure darkness which here began to imprison the creation; I shuddered at the dead sea of nothing, in whose unfathomable zone of blackness the jewel of the glittering universe seemed to be set and buried for ever; and through the night in which we moved I saw the Form which still lightened as before, but left all around it unilluminated. Then the Form said to me in my anguish—"Oh! creature of little faith! Look up! the most ancient light is coming!" I looked, and in a moment came a twilight—in the twinkling of an eye a galaxy—and then with a choral burst rushed in all the company of stars. For centuries grey with age, for millennia hoary with antiquity, had the starry light been on its road to us; and, at length, out of heights inaccessible to thought, it had reached us. Now, then, as through some renovated century, we flew through new cycles of heavens. At length again came a starless interval; and far longer it endured, before the beams of a starry host again had reached us.

As we thus advanced for ever through an interchange of nights and solar heavens, and as the interval grew still longer and longer before the last heaven we had quitted contracted to a point, all at once we issued suddenly from the middle of thickest night into an aurora borealis, the herald of an expiring world, and we found throughout this cycle of solar systems that a day of judgment had indeed arrived. The suns had sickened, and the planets were heaving, rocking, yawning in convulsions. The subterraneous waters of the great deeps were breaking up, and lightnings that were ten diameters of a world in length ran along, from east to west, from Zenith to Nadir; and here and there, where a sun should have been, we saw instead, through the misty vapour, a gloomy, ashen, leaden corpse of a solar body that sucked in flames from the perishing world, but gave out neither light nor heat; and as I saw, through a vista that had no end, mountain towering above mountain, and piled up with what seemed glittering snow from the conflict of solar planetary bodies; then my spirit bent under the load of the universe, and I said to the Form, "Rest, rest, and lead me no farther; I am too solitary in the creation itself, and in its deserts yet more so; the full world is great, but the empty world is greater, and with the universe increase its Zaarahs."

Then the Form touched me like the flowing of a breath, and spoke more gently than before: "In the presence of God there is no emptiness; above, below, between, and round about the stars, in the darkness and in the light, dwelleth the true and very Universe, the sum and foundation of all that is. But thy spirit can bear only earthly images of the unearthly; now, then, I cleanse thy sight with euphrasy; look forth, and behold the images." Immediately my eyes were opened, and I looked, and I saw, as it were, an interminable sea of light—sea immeasurable, sea unfathomable, sea without a shore. All spaces between all heavens were filled with happiest light; and there was a thundering of floods; and there were seas above the seas, and seas below the seas; and I saw all the trackless regions that we had voyaged over; and my eye comprehended the farthest and the nearest; and darkness had become light, and the light darkness; for the deserts and wastes of the creation were now filled with the sea of light, and in this sea the suns floated like ash-grey blossoms, and the planets like black grains of seed. Then my heart comprehended that immortality dwelled in the spaces between the worlds, and death only amongst the worlds. Upon all the suns there walked upright shadows in the form of men; but they were glorified when they quitted these perishable worlds, and when they sank into the sea of light; and the murky planets, I perceived, were but cradles for the infant spirits of the universe of light. In the Zaarahs of the creation I saw—I heard—I felt—the glittering—the echoing—the breathing of life and creative power. The suns were but as spinning-wheels, the planets no more than weavers' shuttles, in relation to the infinite web which composes the veil of Isis ["I am whatsoever is—whatsoever has been—whatsoever shall be; and the veil which is over my countenance no mortal hand has ever raised"]; which veil is hung over the whole creation, and lengthens as any finite being attempts to raise it. And in sight of this immeasurability of life, no sadness could endure, but only joy that knew no limit, and happy prayers.

But in the midst of this great vision of the universe the Form that lightened eternally had become invisible, or had vanished to its home in the unseen world of spirits. I was left alone in the centre of a universe of life, and I yearned after some sympathising being. Suddenly from the starry deeps there came floating through the ocean of light a planetary body, and upon it there stood a woman whose face was as the face of a Madonna, and by her side there stood a Child, whose countenance varied not, neither was it magnified as he drew nearer. This child was a King, for I saw that he had a crown upon his head, but the crown was a crown of thorns. Then also I perceived that the planetary body was our unhappy earth, and, as the earth drew near, this Child, who had come forth from the

XUM

starry deeps to comfort me, threw upon me a look of gentlest pity and of unutterable love, so that in my heart I had a sudden rapture of joy such as passes all understanding, and I awoke in the tumult of my happiness.

I awoke: but my happiness survived my dream; and I exclaimed: Oh! how beautiful is death, seeing that we die in a world of life and of creation without end! and I blessed God for my life upon earth, but much more for the life in those unseen depths of the universe which are emptied of all but the Supreme Reality, and where no earthly life nor perishable hope can enter.

THE RING OF SMALL PLANETS.

By Richard A. Proctor.

OLBERS'S theory or suggestion that the four small planets Ceres, Pallas, Juno, and Vesta were the fragments of a single planet which had burst, was not hopelessly untenable; for the mean distances of these four planets are nearly equal, being 2·769, 2·771, 2·668, and 2·361 respectively, the earth's distance being unity. Indeed when Olbers first suggested the theory, only two of the small planets had been discovered, Ceres and Pallas, and these travel at almost the same mean distance from the sun. In the *Connaissance des Temps* for 1814, Laplace showed that with a velocity of explosion not exceeding twenty times that of a cannon-ball, say twelve times that of a ball fired from one of our best modern cannon, the observed range in the mean distances of these bodies might have been obtained. It is, however, to be noticed that even for this the Pallas fragment was assumed to have been expelled directly forwards and the Vesta fragment directly backwards (with reference to the course of the planet at the moment of the catastrophe, in order that the whole effect of the change of velocity might fall on the period, lengthening to the utmost that of Pallas and shortening to the utmost that of Vesta. If the picture illustrating this article is examined, it will be seen that the range in the known mean distances of the asteroids has enormously increased since then, and that even in this aspect alone the explosion theory is no longer so hopeful as when Laplace held it to be barely tenable.

But another objection, first dealt with by Encke, has always been held more serious, and has now become to all intents overwhelming. It was seen by Olbers and his contemporaries that whenever such an explosion occurred the new orbits of the scattered fragments must pass through the point where the explosion took place. They found no such point common to the orbits of the four first-discovered asteroids. Professor Newcomb says it is curious that they expected to find a region of intersection, as it implied (meaning that their intersection implied) that the explosion had occurred within a few thousand years. It would have been curious, however, if in Olbers's time men had expected anything else. However, whatever their expectations may have been, it is certain they found no such region of intersection. Encke showed even that, judging from the present variations of the orbits of the asteroids there was less approach towards a region of common intersection in past ages than there is at present. But a more careful investigation of certain of the asteroidal orbits has shown that, apart from the attraction of the small planets on each other, the orbits examined never *could* have intersected. And as the attractions of these planets on each other are exceedingly small it is practically impossible that the divergence of the system from a state of things which *must* have existed if ever a planet burst in the mid-region between Jupiter and Saturn, can be explained in this way.

Hence, as Professor Newcomb rather abruptly puts it, "Olbers's hypothesis is no longer considered by astronomers."

The physical objection to the theory lies in the circumstance that though in a great volcanic outburst the earth's internal forces suffice to eject matter with velocities comparable with those required by the hypothesis, we have in these cases the energies of enormous subterranean regions exerted on relatively minute bodies. To conceive that the energies even of the whole earth, if all brought into action at once, could suffice to propel the whole mass of the earth—in fragments—from around the centre of explosion, with velocities enormously exceeding those ever observed in any fragment ever shot out from a volcanic crater, is a very different matter indeed. A certain charge of gunpowder will drive a cannon-ball to a distance of two or three miles, but a thousand times that charge would not scatter the fragments of the cannon (if the ball had been tightly fixed in) over a similar distance all around the place of explosion. Nothing known about our earth's interior, nothing which we can infer about the interior of any other planet formed by processes such as we recognise in the development of the solar system as at present understood, suggests the possibility that a millionth part of the force necessary to shatter a planet, as Olbers's theory requires, can ever be generated and accumulated within the planet's interior.

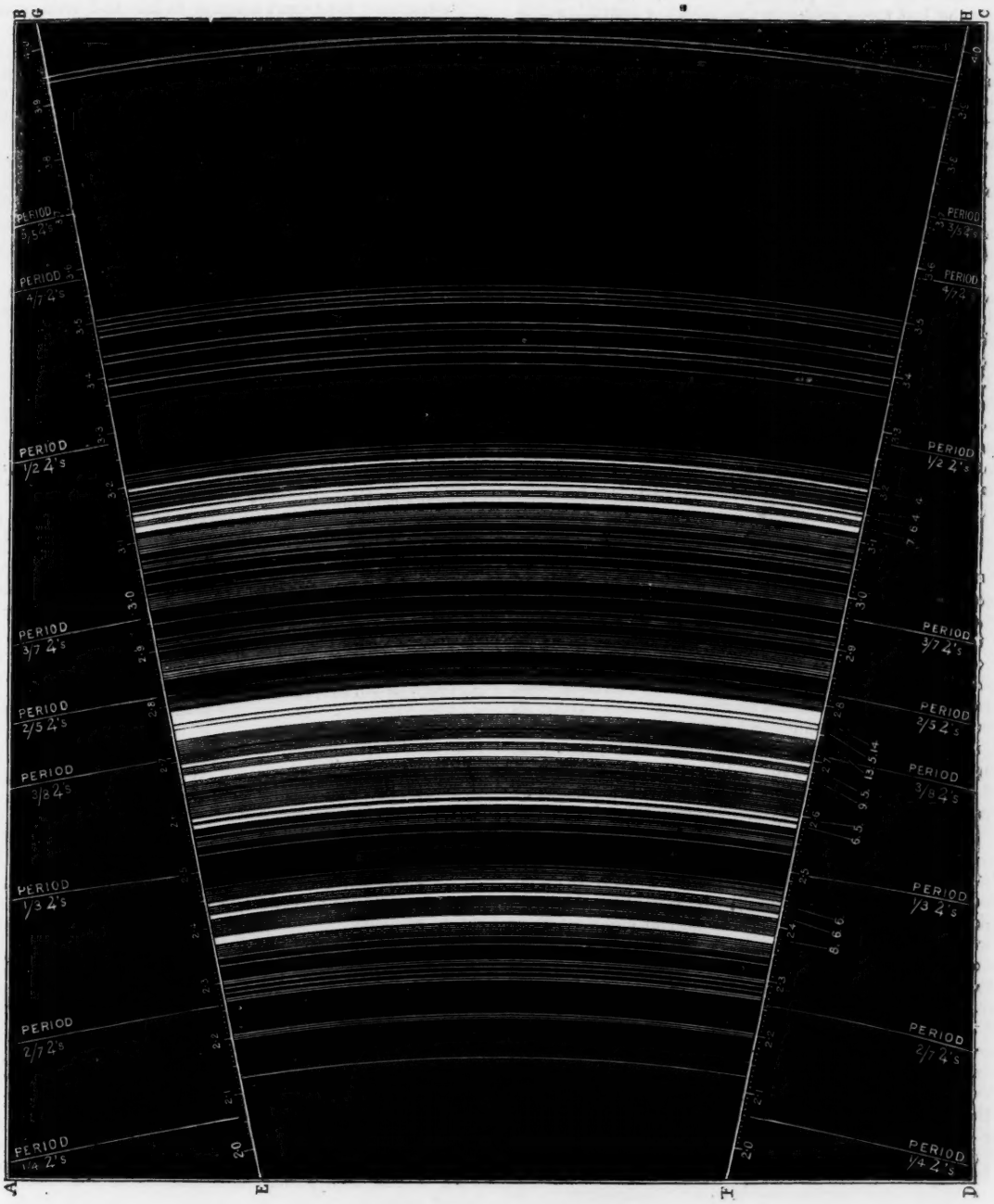
But while the nebular theory gives a sufficient explanation of the existence of a zone of small planets instead of a single planet, this theory associated with the theory of meteoric aggregation which recent discoveries have established, gives also an account of the position of the zone of asteroids in the solar system and also of certain peculiarities which it presents under careful scrutiny.

On the former points I shall make some remarks next week, endeavouring to show that the zone of asteroids belongs to the region separating the sun's special family of small planets, from the region where orbs which not so very long ago were minor suns travelled with their attendant families of worlds.

For the present I note only the significance of that strange feature which Professor Daniel Kirkwood of Bloomington, Ind., was the first to indicate,—the gaps in the asteroidal system at those mean distances for which the attraction of Jupiter would have been most effective—in past ages—in disturbing the movements of meteoric or nebulous matter. It is well known that when two bodies travel around a centre in commensurable periods, the perturbations which with incommensurable periods would be ineffective in long periods of time, become very effective, especially if the periods are so related that a few circuits renew the disturbing influences. We see this in the case of Saturn and Jupiter, where two revolutions of the outer planet are accomplished in nearly the same time as five revolutions of the inner; hence arising the Great Inequality or Irregularity. The smaller body is the one always which is most disturbed. A vaporous or meteoric mass moving in a period similarly synchronising with Jupiter's would be very much more disturbed than a larger one, for precisely the same reason that (for instance) the moon's departures from the common centre of gravity of herself and the earth are much greater than the earth's. Such a mass would be driven to one side or the other of its original track until it would probably come into collision with one moving in a longer or a shorter

period; and so that particular case of synchronism would be eliminated. In millions, or perhaps tens or hundreds of millions of years, nearly all cases of synchronism would in that way be eliminated.

synchronise with Jupiter's in various simple ways, are indicated, and also all the asteroidal mean distances at present known. When Professor Kirkwood first noticed the peculiarity, not half as many asteroids had been dis-



PATHS OF THE ASTEROIDS,

Distributed according to their Mean Distances, showing the gaps at those distances where the Orbital Revolution would synchronise with Jupiter's.

Whether such a process has been at work or not in the asteroidal system let the illustrative picture show, where the distances at which asteroidal movement would

covered. Yet still, as more and more are found, the law is more and more clearly indicated.

(To be continued

Editorial Gossip.

It would not be right to pass without a word of recognition the very kindly greeting given me in Plymouth during the last three weeks, where crowded audiences met to hear each of my six lectures, giving me also the greatest compliment a lecturer can have—constant attention—though owing to the great size of the Guildhall and some slight acoustical difficulties the lectures were not given under quite the conditions that (for my audiences' sake) I prefer.

One hears with regret of the difficulties under which Mr. Matthew Arnold gave his first lecture in America. Want of practice in public speaking, and perhaps some vocal weakness, must be assigned as the reasons why Mr. Arnold was not heard throughout Chickering Hall; for the acoustical properties of that hall are almost perfect. During my four visits to New York, I have lectured in Chickering Hall ten times, in Association Hall eight times, and in Steinway Hall (which seats 2,000) twelve times. All three are good; but Chickering Hall is the best. How reading instead of speaking may affect the sound of the voice there, I cannot say, as I have never read during my lectures; but I should suppose no one who really wished to influence his audience actually reads: he may refresh his memory by an occasional look at his MS., but not read word for word from it.

New York while accepting English judgment as of weight in literature, regards it—according to the *Tribune*—as absolutely without weight in art. Hence after their first few nights, Mr. Irving and his company have had to rely on their qualities rather than on the credit they have attained at home. It is not altogether surprising that, thus tried, Mr. Irving has not at once leapt into favour in America. For there is much in his acting to mar the effect and influence of his real merits. But in the long run—though the attendance has for awhile thinned—his sterling good qualities must tell. As to Miss Terry's success in America there can be no doubt.

In answer to several correspondents I note that my lectures at the Kensington Town Hall, on Monday, Wednesday, and Friday next, will begin at eight. I trust all who can will be in their seats at that hour. A lecturer is sometimes blamed for waiting a few minutes when part of the audience is still coming in at the announced lecture hour. It *does* seem unfair to those who are there in time. But it is not in reality his fault. If he begins while still there is the sound of entering footsteps, he is not properly heard; and therefore in the interests of his audience he is bound to wait a little. But it is not fair on the part of those who come late (at least if they can help coming late—as they generally can) that the rest of the audience and the lecturer should be put to inconvenience.

The first lecture, on the Birth and Death of Worlds, will close with De Quincey's version of Richter's Dream. De Quincey's translation of that Dream (a very different matter), is given this week for comparison. The second lecture, on the Sun, will close with Vega's Poem which appeared in Knowledge for October 12, No. 102. The third and last lecture, on the Moon, will close with Anster's singularly fine translation of a famous passage in Goethe's Faust, beginning

See! all things with each other blending, &c.

Considering the recent attempt to kill and maim many British folk in the Underground Railway, it is a curious question—let the miscreants who made the attempt be who they may—whether a theory of evolution associating man closely by kinship of blood with the most hateful of the brute creation, would not be a relief from the thought that those wretches are akin to us.

THE FACE OF THE SKY.

From Nov. 9 to Nov. 23.

By F.R.A.S.

The student will not fail to point his telescope to the sun on every clear day. Map XI. of "The Stars in their Seasons" shows the stars at present visible in the night sky. Mercury is now moving rapidly behind the sun, and is, for the observer's purpose, invisible. Venus is practically invisible, too, from her great south declination. Mars does not rise until between 9 and 10 o'clock at night, but, of course, does so sooner every day. He is still only fairly observable in a powerful telescope. Jupiter does not south until the morning hours, but he is some 23° high at midnight to-night, and 8° or 9° higher at the same hour by the 23rd. His place in the sky varies but little from that described a fortnight ago on p. 261. The phenomena of his satellites visible before 1 a.m. during the next fourteen days are as follow. On November 12 Satellite III. will pass off his disc at 11h. 14m. p.m. On the 14th the shadow of Satellite I. will enter on his face at 11h. 56m. p.m. On the 15th the same phenomena will occur with the shadow of Satellite II. at 11h. 28m. p.m.; 40 minutes after midnight, Satellite I. will reappear from occultation behind Jupiter's disc. Satellite I. will begin its transit over Jupiter on the 16th at 9h. 57m. p.m, and the shadow of Satellite IV. enters on to his limb at 12h. 1m. p.m. On the 17th Satellite II. will reappear from occultation at 11h. 39m. p.m. The shadow of Satellite III. will enter on to the face of the planet at 10h. 9m. on the night of the 19th, and will be followed by Satellite III. itself at 11h. 24m. On the 22nd Satellite I. will disappear in eclipse at 11h. 3m. 37s. p.m. Lastly, the shadow of Satellite I. will leave Jupiter's disc at 10h. 38m. p.m. on Nov. 23, to be followed by the Satellite casting it at 11h. 47m. p.m. Saturn is above the horizon during the greater part of the night, rising as he does by the 23rd of the month about 22 minutes past four in the afternoon. He is still above Aldebaran. He is an all-repaying object just now, even in the most moderate telescope. Uranus continues invisible, but Neptune, as we have so often said lately, may be picked up as a small 7th mag. star in that blank part of the sky south-east of δ Arietis. The Comet discovered by Pons in July, 1812, and rediscovered in America by Brooks on September 2 of the present year, is now visible, with but small optical aid, in the constellation Draco. During the period covered by these notes, it will describe an arc very rudely parallel with a line joining β and γ Draconis ("The Stars in their Seasons," Map XI.). On the night of November 9, the Comet will be found less than 1° south and a little to the west of β; and some 1° 40′ due south of that star on the 11th. It will be situated about 2° south of γ Draconis on the 20th. From these data, its path may be laid down on the map with sufficient accuracy to enable the observer to fish for it in the sky. As yet, it has developed no proper tail, so-called, in any moderate-sized instrument; but presents the appearance of a minute stellar nucleus surrounded by a diffused nebulosity.

The Moon's age at noon to-day is 9·5 days, and quite evidently will be 23·5 days at the same hour on Nov. 23. She will be fairly well placed for the observer during the greater part of the next fourteen days. During that period two occultations of stars only occur before midnight. The first is that of the 6th mag. star B.A.C. 1119, which will disappear at the Moon's bright limb at 8h. 12m. p.m. on Nov. 14., at an angle from her vertex of 29°, and will reappear from behind her dark limb at 9h. 2m. p.m. at a vertical angle of 287°. The second one is an occultation of A^2 Cancri, a 6th mag. star, which on the night of the 19th will disappear at the Moon's bright limb at 11h. 24m. at a vertical angle of 66°, to reappear at her dark limb at 12h. 19m. at an angle from her vertex of 191°. The Moon is travelling across Aquarius to-day and to-night, but about 3 o'clock to-morrow morning will cross the

boundary into Pisces. She will take 72 hours to pass through this great constellation; in other words, it will be 3 a.m. on the 13th ere she quits it for Aries. She will have traversed Aries by 4 o'clock in the afternoon of the 14th, when she passes into Taurus. Here she remains until midnight on the 16th, when she enters the extreme northern part of Orion. It takes her until 11 a.m. on the 17th to traverse this, and she then emerges into Gemini. Her path over Gemini occupies her until 2 a.m. on the 19th to describe. At this hour she enters Cancer. By 5 o'clock in the afternoon of the 20th she has quitted Cancer for Leo. She descends in Sextans about 3 p.m. on the 21st. At 2 p.m. the next day she re-enters Leo, and it takes her until 4 p.m. on the 23rd to travel over the remaining part of this constellation. At the time mentioned she passes into Virgo. We there leave her.

"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

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NO COMMUNICATIONS ARE ANSWERED BY POST, EVEN THOUGH STAMPED AND DIRECTED ENVELOPE BE ENCLOSED.

THE GREEN SUN IN INDIA.

[992]—I last evening received a letter from a gentleman residing at Trichinopoly, dated Oct. 2. It may be interesting, perhaps helpful.

"There has been a very curious phenomenon seen the last three weeks or so in the rising and setting sun. It presents for a time after rising a light green appearance, and again the same colour a little time before setting. It is very curious to see its colour on the walls of my bed-room of a morning. The natives are in great dread, fearing it portends some great calamity." S. NEEDHAM.

[The length of time named is remarkable.—R. P.]

A CURIOUS PHENOMENON.

[993]—I have just seen Mr. Noble's letter in No. 98 of KNOWLEDGE, describing a comet-like appearance in the Eastern horizon before the rising of the moon.

A similar cone of light to that represented in his sketch—with the exception that the tail was broader and not so long, and the lines of cloud were nearer the horizon—was witnessed here by myself and several others one evening in July, about 7.30 p.m. Thinking it might be the tail of a comet, I went into the house to prepare my telescope, with a view of directing it upon the nucleus directly it arose, but, while thus engaged, the whole faded away.

It was as nearly as possible E.S.E. over the Karwendel range of mountains, and could not have been caused by light from a town or furnace, there being nothing of the sort for miles and miles. The moon rose about the same spot rather more than an hour afterwards. M. F. W.

[994]—With reference to the paragraph in KNOWLEDGE, numbered 826, and headed "A Curious Phenomenon," I have a few remarks to make. It is generally known that lightning presents itself in various forms, sometimes as sheet lightning, sometimes as forked lightning, and sometimes, but more rarely, as earth lightning. This earth lightning, instead of dropping from the sky, rises from the ground, taking sometimes the form of a fiery globe, and sometimes that of a fiery pillar. I have now before me an account of one of these fiery globes which struck a nunnery at Bologna, and which emerged from a large hole into which the street water emptied, finally expending its fury by knocking down a portion of a tower.

I would suggest that it was a phenomenon of this nature that was witnessed by Mr. Noble on the 28th of last month, and respecting which he solicited explanations from the readers of KNOWLEDGE. I may add that many years ago my wife saw a precisely similar exhibition to the one depicted in Captain Noble's sketch, when walking one evening in the fields in a rural district in the west of France, many miles away from any town or even village. She says the sketch given in KNOWLEDGE represents what she saw on the above occasion as perfectly as if she had drawn it herself. I myself, about fifteen years ago, whilst driving one evening in a country district a few miles north of Bolton, in Lancashire, saw three pillars of fire rise out of the earth within a few yards from my phaeton. The first pillar rose on my left-hand side; then, after I had proceeded about a quarter of a mile, a second pillar rose on the right-hand side; and the third one appeared at the junction of two roads a few hundred yards further on. These fiery pillars seemed to be, as far I can recollect, about twelve feet high, and in circumference about the same as the funnel of a large steamer. My groom, who sat beside me, saw these appearances as distinctly as I did myself, and the same may be asserted with respect to my horse, which was so terribly frightened that it required all the restraints possible of reins, and soothing persuasion of voice, to keep him from bolting off in a frantic gallop. G. M.

[Arago cites many cases of globe-lightning; but "G. M." scarcely makes out the connection between the phenomena described by Captain Noble and what he witnessed himself. We have no evidence, by the way, that forked lightning drops from the sky.—R.P.]

BRILLIANT RAINBOW.

[995]—The most briliant rainbow I remember having ever noticed was visible from here (Peckham) on Oct. 21, at about 4 p.m. Both the primary and secondary bows were bright and, as far as the houses allowed them to be seen, complete. Inside the primary, and seeming to touch it, was a third bow, colours reversed, and very faint. This sight made me look into the theory, and I find that this faint bow is the sixth. The fifth, which should be between the first and second, was invisible, a circumstance of which an explanation would be welcome. V. COTTER.

NEW MOON ON SATURDAY—DAY OF WEEK.

[996]—That the writer of the "Companion to the Almanac" and the corrector of all paradoxes should himself make a slip when trying to excuse one of his *protegés*, shows only that he was human. The occurrence of new moon on Saturday, March 24, 1859, brought to light defenders of the old sayings about bad weather connected with Saturday's new moon and Sunday's full. To expose the want of evidence for these proverbs was not difficult for Professor de Morgan, but, in further speculating on the subject, he based an argument on the likelihood that the completion of the lunar cycle would bring back the Saturday's moon (see pp. 195 and 196, "Budget of Paradoxes"). Nineteen years later, found a new moon on the same date, but, alas! it was Tuesday, March 24, 1868, instead of Saturday.

To calculate mentally the day of the week for any given date is a species of number-conjuring more practically useful than some recently contributed to your pages.

The given date is analysed into four parts—(1) hundreds, (2) years (without the hundreds), (3) month, (4) day of month. Each one of these four parts contributes a week-day equation as follows:—Say for Sept. 13, 1883.

I. HUNDREDS.—Divide by 4, and subtract twice the remainder from 6.* 18÷4 leaves 2; twice 2 from 6 leaves 2.)

II. YEAR.—Divide by 4; and from twice the quotient subtract the remainder, and subtract what then remains from the nearest multiple of 7 (83÷4=20+3; twice 20−3=37; 37 from 42 leaves 5.

III. MONTH.—The equations for the successive months are:—1, 4, 4; 0, 2, 5; 0, 3, 6; 1, 4, 6. They can be committed to memory more easily by threes, calling them 12 squared, 5 squared, 6 squared, and 12 squared plus 2. (September=6.) If date is in January or February leap-year, subtract 1.

IV. The day of the month is its own equation (13).

These four equations of the day of week (2, 5, 6, and 13) are added together (26), divide by 7, and the remainder (5) is the day of week (Thursday). If 0 remains, it is Saturday. A rapid calculator can give the answer almost instantly.

J. GREEVES FISHER.

* This is the rule for New Style, which began on Thursday, Sept. 14, 1752. Old Style ended on Wednesday, Sept. 2, 1752. For Old Style dates add 3 to the hundreds, and subtract total from a multiple of 7.

XUM

MUD-GUARDS FOR TRICYCLES.

[997]—May a Tricyclist in difficulties turn to KNOWLEDGE and Mr. Browning? I believe in small wheels geared up, but they splash more than big ones at the same pace. I need to ride with a clean coat. Riding in a jacket with a light coat for calls or meetings will not always do, *e.g.* for dining out. My old "Excelsior" (wheels 20 in., 30 in., and 50 in. geared level) kept me fairly clean except in gales of wind, so long as I kept to five and a half or six miles an hour over the worst mud. A "Meteor Sociable" (40 in. level) plastered my arm a quarter-inch thick with mud the other day. Even the "Humber" pattern, which I like best, splashes me a little (44 in. level). I do not want to give up tricycling for the purposes of my daily work. Is there any help? D. M.

CHESTNUTS AND BEECHMAST.

[998]—In the case of strong trees, with plenty of light and air, both the chestnut and the beech are fertile in West Worcestershire and its neighbourhood, while the sterile husks are common where trees are crowded.

My father planted several chestnuts, as young trees, in 1845. Twenty years or so later the nuts on the "spotting" trees among these were as fine as the imported chestnuts of the shops, and were in great abundance. There was usually one nut squeezed up and empty in the husk, which contains three. I believe that these trees continue fertile. Older and sturdy beeches on the same land were also fertile. F. S. L.

BEECH MAST.

[999]—Mr. Grant Allen says in his latest chapter of the "Naturalist's Year" that in Britain the nut or mast of the beech is almost always sterile, and he emphasizes this by pointing out the correlative fact that the beech is in a decadent condition in this country. With all possible deference to this delightful writer, I beg to assert that, as a boy, I have eaten hundreds, perhaps thousands, of these nuts (their kernels I mean), and I can state positively that in Hampshire, and also in Oxfordshire, an enormous number of them come to perfection, *I should think one half*—though this estimate, I admit, is little more than a guess. At any rate it is not the fact, as least so far as the counties I have mentioned are concerned, that the "beechnuts or mast *rarely* contain a kernel." F. M. DUPLOCK.

TOTAL ABSTINENCE.

[1000]—In your issue of Sept. 14th, p. 166, Mr. W. Mattieu Williams gives a thrust at the practice of totally abstaining from alcoholic drinks, or, perhaps, better at those who try to induce others to so abstain. He tells us that, after some days' privation from food of an agreeable kind, he came to a station at which he was able to obtain food to please him, and also *claret*. It is to the latter that we owe his experience. He tells us that the "*first* glass of claret produced an effect that alarmed me—a craving for more and for stronger drink that was almost irresistible." He then goes on to urge that food reformers might do more good than temperance reformers. Temperance reformers fully recognise the help that better food may yield them; but does it not occur to Mr. Williams that since the intense craving *followed* the consumption of the *first* glass that, if the first glass had not been taken, the craving would not have arisen? I fancy the main point with most total abstainers is, if you don't want the craving, don't excite it. I think our thanks are due to Mr. Williams for thus unknowingly affording us proof of the soundnes of our doctrine.

W. T. POSTLETHWAITE.

INTERNAL PARASITES.

[1001]—Will you kindly allow me to inquire through the medium of your columns, for an explanation of certain discoveries I made one morning in a piece of cod's liver. On taking it up I observed several hard excrescences, and upon cutting them away was astonished to find a fine thread-like worm, curled up like the mainspring of a watch. Upon my separating them with great difficulty from the liver which they had almost become a part of, and putting them into a phial of water, they swam about with ease, and have lived for several hours, and, indeed, are alive at this present moment, although taken from a dead fish, which must have been so for twenty-four hours at least. I have also observed the same phenomenon in the livers of other animals, such as fowls, rabbits, &c., but did not experiment until now. I would gladly know if such parasitical livers are injurious if eaten by man. I would also like to know what those small star-like bones found only on the back of turbot are. AMY BRIGGS.

LETTERS RECEIVED AND SHORT ANSWERS.

ATOM. If the sun is represented by a globe 2 ft. in diameter at your house in Sloane-street, and Neptune by a plum on Clapham, common, a globe 3½ ft. in diameter, at a distance of sixteen or seventeen thousand miles would be about right for the nearest star-and if the surface of this globe had the same intrinsic lustre as the sun's surface it would look like a star, of about the same brightness as Alpha Centauri. Where the globe should be fixed I cannot tell you. I said "*more* than 200,000 times the sun's distance"—about 210,000 time would be nearer the truth.—A CONSTANT READER, E. M. DEARMAN. Thanks; printer's error, I expect.—JOHN H. TYSON. Do not the words "Unknown, yea evermore Unknowable" remove all the untruth of which you speak? Vega seems, like Darwin, to express—after some fluctuations—a feeling akin to that which underlies the higher Agnosticism. There is no more any actual assertion of doctrine than there is any deliberate statement on his part that the conversation described really took place. The whole thing is intended, I should imagine, by way rather of symbolisation than of description. It would, of course, be "caviare to the general."—VANESSA. The idea is excellent. Will submit it to F.R.A.S.—F. RICARDO. Thanks for the note, which shall appear as soon as possible. What an absurd thing is the common estimate of singers: A, with a pure and beautiful tenor voice (but ranging not higher perhaps than A natural), a true ear, and the power of throwing the right expression and as it were the true emotions into his vocalisation; B, with a voice strident if not absolutely harsh, an untrustworthy ear, and no power of expression whatever, capable of throwing neither softness nor fire into his singing, but able to strain out the Ut de Poitrine; yet B shall be regarded as a great tenor and A as but a second-rate singer.—P.S. There is no truth whatever in the notion that the sun puts out a fire, though there are many who "know" that the sun does so, and that a poker across the top bar makes a fire burn up.—H. A. BULLEY. Letter marked for insertion.—F. W. WOOLER. Know as yet nothing personally; may shortly do so.—IGNORAMUS. A comet is *always* more or less under the sun's influence. When nearer to him the comet has greater velocity, and therefore greater centrifugal tendency. At its nearest this tendency suffices to balance the tendency to approach, and thenceforward the comet recedes. See, however, for fuller explanation of elliptical motion my treatise on the Sun where this point is considered at some length.—A LADY MATHEMATICIAN. You should rather say that Helmholtz conceived the possibility of some one conceiving straight lines which after diverging might begin to diverge. The papers you consider "rubbish" I find charming—so greatly do tastes differ. (This refers to one only of the writers you name. The other is too nearly related to myself for me to express an opinion.) Your letter *does* refer to *some* rubbish with which I will not fill my paper. "Even Hampden," as you say, "would be better than that."—T. B. WALKER. Marked for insertion; though when there may be room, I cannot say.—HALLYARDS. Your talk about poetry not very instructive: most prosaic. But a Philistine is not expected to understand Gujerati.—C. E. RANKEN. Membership of the British Association is secured by attending meetings and paying either the annual subscription of two guineas, or a life-subscription the amount of which is unknown to me.—S. S. MCILWRAITH. No answer which could be given here would be of service to you. The subject is too difficult to be dealt with in these pages.—HARRY ST. Excuse my omitting your exasperating and extra-aspirated joke. The papers on the spectroscope soon.—BERKS, J. E. LUSH. Regret that long experience forbids my giving such advice here.—S. ORR (?). I think the saying on Fitzroy's Barometer, "Sudden rise after low foretells strong blow," very unsatisfactory; but have not noticed that "sudden rise after low" is usually followed by rain; though it may be.—C. L. SWEEDALE. See note on subject.—UNCERTAIN. You leave me more uncertain than ever. Who on earth knows? is really all I can say.—C. D. Term "range," as you suggest, quite unscientific.—H. SMITH. Perhaps some correspondent may know how you should keep and feed chameleons through the winter.—THOS. RADMORE. No space for your note. Probably your clock time was inexact.—CARLTON. The idea of the "lost Pleiad" might be suggested to a child in these days as readily as to a race of men at any past time. For there is no reason to believe that the fainter seventh star ever was as bright as the others. Seven stars can be seen by eyes of certain degree of power, one of the stars being fainter than the others; what more natural to the fanciful mind of child-races, than the idea that that star had once been like the others but had lost its original lustre, especially if the stars had come early to be known as "the seven," which they would be very apt to be.—V. COTTER. Letter marked for insertion.—J. J. T. That result means simply that F for 150 lb. falling 9 ft., would be the same as for 38 tons with a velocity of 1 ft. per sec., which would be attained

after falling ⅛ths of an inch. The formula is correct.—H. C. STANDAGE. Can find no trace of the paper. Will make inquiries.—F. H. GLEW. It is not easy to determine the use of the instrument of which you send photograph. It seems intended, *inter alia*, for use in map projection. If I were more at home I would ask you to do what you suggest; but sending the instrument to me when I am so seldom in town would involve the risk of its being lost or injured in following me on my travels.—AN INVALID would like advice as to the most suitable tricycle for one suffering from chronic weak back, and unable to ride inclines with the tricycles usually to be hired.—MUFF. My opinions about the ancient Phœnicians would not be worth much.—A. ARCHER. Away from home] so cannot hunt up references. The article on "Lotteries" came out in the *Cornhill Magazine*, not in *Good Words*. It is republished in one of my volumes of "Essays." Forget which. Messrs. Chatto know.—ST. C. LUCAS. Fear no known vibrator, photographic plates, or selenium cells, would do what your plan would require,—in particular, the complicated vibrations of a diaphragm affected by the voice are not suitable.—D. MCCULLOCH. Could not venture advice on such a subject.—JOS. HORNER. Space considerations have caused delay. Hope to use the papers.—F. COWLEY. That is the right way to get the fourth decimal correct. On the other and more general question it is not possible to give advice. A simple treatise on geometrical conic sections would be good for you and interesting to you.—W. H. JONES. The difficulty is to get scientific evidence that spontaneous generation ever occurs; until this has been done we cannot discuss in a scientific way the possibility of spontaneous generation or the conditions suitable for its occurrence. Science can only keep on trying, and when it fails admit as much.—D. M. desires to know whence cats obtained (1) their ideas of medicine, and (2) their love of fish. He suggests that Egypt taught them both. *Quien sabe?*—F. JACKSON. Letter forwarded; one from another correspondent on same subject already in type.—F. THOMPSON. Pardon me, I am *not* "at length ready to enter into controversy with any rational advocate of the flat earth theory except Parallax and Mr. Hampden." *Imprimis*, I have never yet come across any rational advocate of the theory, and I cannot imagine the existence of one; then, if I had, though I should have been surprised, should have felt in no way interested to controvert views so absurd. I have never taken the least interest in the flat earth theory except for the evidence it gives of what some *can* believe. I offered to consider any difficulty and show where the explanation lay. But I did not offer to make my explanation such as would be understood by the person to whom it was proffered. One cannot get a quart into a wine-glass (not by a jugfull). Your difficulty that because a small hill will hide the lower parts of a distant object, therefore there is no force in the evidence derived from the sea hiding such parts of objects, is no difficulty at all. In each case something hides something else and is therefore between the eye and that something. The flat-earth folk try to make out that the sea is *not* really in the way. Your argument really asserts that it is. Then you say the earth's surface is represented correctly enough on flat maps. Try it. Show in a map the North Pole, the equator as a circle round it; and then—not troubling about filling in that circular space—show Australia, South America, and Africa outside the equatorial circle, with anything like the proper relative distances in a north-and-south and also in an east-and-west direction (distances determined by multitudinous measurings—even though here and there parts have escaped measurement) and it will be time to think about flattening the earth. Even then I should like to see your idea of the star-sphere, in which the groups of stars, always unchanging, fill the complete surface—leaving no room for anything but a spherical interior. Note also that at the equator, you have only to wait from sunset to the next sunrise to see the whole interior of that star-strewn sphere.—E. C. H. Glad to hear that Vega's lines as recited by me at the end of my Worthing lecture (the first time I so used them) pleased you so much. Vega will be pleased too.—H. E. M. When broken glass is joined by fusion, nothing I believe is put between them.—E. PRICE EDWARDS. Much obliged but no space.—MOLTO GRAZIE. Papers will be collected.—W. H. GOY. In the only case when I saw a "dancing sailor" there were fine threads. Should require to know more about the matter before I put it as an example of electrical action.—A. T. BIRCHAM. Thanks. Another note to same effect in type.—ED. LUXMORE. I agree with you. But the statement you object to was widely published and not contradicted. On the other subject, being twitted with burking controversy I thought it best to give due allowance of rope for self-hanging.—J. H. B. F.R.S.A. proposes to treat of that and similar simple telescope matters.—JAS. A. GEE. Shadow has not unfrequently been seen in fog and cloud. J. A. MCDERMOT. Know of no useful books on Heraldry.—J. K. R. Moves of Knight dealt with, I think, in a book by Walker: but question should have been addressed to Chess editor. The nines problem depends on the well-known one that if from a number you subtract the sum of its digits, the sum of the digits in the difference is a multiple of nine,—a property explained repeatedly.—PITT. (1) Max Müller's date is far enough back to agree with my statement as to the high antiquity of the constellation figures. (2) As to spectrum analysis, I thought you referred to the evidence as to nature of substance not as to condition. On this last point it is likely enough we may have to modify our views.—C. L. LIVERDALE. Thanks: but have no other accounts with which to compare yours and so get actual path of the body.—A HOEDEN. Doubt if author of that sum could now be identified.—W. HAMPTON. Fancy I catch your drift: "I should smile to twitter."—CHAS. COOKE. Your "curious fact" amounts to the following formula:—

$$2x+(x-1)^2-1=x^2;\ \text{or}\ (x-1)^2=x^2-2x+1.$$

This is not, strictly speaking, a new property.—C. FEW. Rather more space than can be conveniently spared to show how by multiplying and adding large numbers you can get 1 followed by a number of zeros, and then removing 1 get *nothing*. UC few, C. Few, 00. (U can,—doubt, DO that).—S.B. Thanks; but no space for attempts at spelling reform.—HAMILTON would like to be told some simple way of demonstrating the presence of sewer gas in the air, when denied by smell-wanting folk.—J. GUARDIA. Thanks.—RAPHAEL R. MAY. In England a billion means a million millions, or a million to second power, a trillion a million million millions, or a million to third power, and so on. In America and on the Continent the absurd system you mention is adopted, according to which no uniform explanation of the *bi-*, *tri-*, *quadri-*, &c., in these number names can be given.—R. C. SHETTLE. Thanks for paper on terrestrial magnetism.—A SUBSCRIBER. Cannot explain abnormal action of weather barometer.—VERMICULUS. Regret no space; pity you did not witness end of encounter.—E. H. Soon.—VIGNOLES. Have received no other observations of meteor with which to compare your very accurately and usefully rendered ones.—HEALTH. Do not know how light may be increased. Hair certainly weakened by wearing cap.—J. Y. Why certainly; if your watch is set right for Greenwich time and rightly rated, it will be 5 h. 35 m. wrong by New York time when you reach New York. What else would the difference of time between New York and Greenwich mean?

Our Whist Column.

BY "FIVE OF CLUBS."

ON SIGNALLING AT WHIST.

IN the Whist of our time there is a complete code of signals by which information as to the state of a player's hand may be conveyed to his partner, but at the same time to the adversaries. I have in former papers described these signals, though they are indeed well known to all Whist-players. I have also in some of the illustrative games which have appeared in these columns from time to time, shown how by means of these signals a player is often enabled to forward the development of his own and his partner's strategy. The Whist editor of the *Australasian* in a number which has just come to my hands points out with a good deal of truth that only the good effect of signalling is thus shown in illustrative games. In numbers of cases signalling, and even such conventional rules as returning the highest of two and the lowest of three or more, help the adversaries much more than the partner. The question hence arises whether even if signalling be not regarded as always dangerous and on the whole more apt to be mischievous than useful, it should not be much more cautiously adopted than Cavendish and other advocates of the system suggest. During the last two years I have paid a good deal of attention to this question, first brought to my notice by "Mogul" in those columns—and I must confess that in a majority of games which I have analysed although signalling did not in every case (not more than about half) defeat the object of the signallers and help the adversaries it would have done so if the adversaries had taken due advantage of what they were told. Thus my observation though not enabling me to go quite as far as the Whist Editor of the *Australasian* in the following passage, points in the same direction:—

"Five of Clubs' illustration" (he is referring to a case in which we had shown how by departing from book-rules a game was saved, the departure arising from the adversaries' signals) suggests "the reflection that, by the adoption of the penultimate signal, a Whist-player may give his adversaries just the information in regard to the constituents of his hand which will indicate to them the lines on which to proceed if they wish to take the best chance of saving the game. This disadvantage is not peculiar to the penultimate

signal, but is inherent in all the modern conventions, including the call for trumps. We have said on a previous occasion that 'the main difficulty with which a common-sense Whist-player is confronted is how to give his partner enough of general information about the state of his hand without telling his adversaries too much.' But this is a problem, the very existence of which, as it seems to us, the modern petrolateur insists on ignoring. His doctrine is, not that it is the duty of a Whist player to tell the truth, and nothing but the truth; but that he shall tell the whole truth, with all possible detail, to partner and adversaries alike. In other words, by the use of conventional signals, he aims at assimilating the practice of Whist to the practice of double dummy. The result is that, when the combined hands are weak, he loses many a game which a common-sense Whist player would save; and that, over and over again, when the combined hands are strong, he just fails to win the game through giving the adversaries detailed information which he had far better keep to himself, and which is not in any degree essential to the effective combination of his own and his partner's cards. The illustrative hand from the *Field** indicates the danger that characterises the Whist of the conventional school. But the great majority of published examples of the petrolatic system are selected with the view of proving that the modern conventions are good: and, as a rule, little or no notice is taken of the numberless Whist hands in which the adversaries avail themselves of the information afforded by the signals to defeat the object of the signaller. Doubtless the advocates of the modern system are wise in their generation; but, despite their reticence, we have seen enough of the consequences of adopting their fads to feel justified both in forming and expressing an opinion as to their real value. That opinion is that the cases in which the conventional signals are of use are, generally speaking, just the cases in which the combined hands would work together effectively without their help. This, at all events, is the result of our personal experience, and hence we feel anxious that the Whist-players of Australia, for whom we write, should carefully consider the *pros* and *cons* of the matter before they decide on enrolling themselves as members of the coterie of which Cavendish is the recognised leader, and on accepting his later teachings as *bond-fide* improvements in Whist practice."

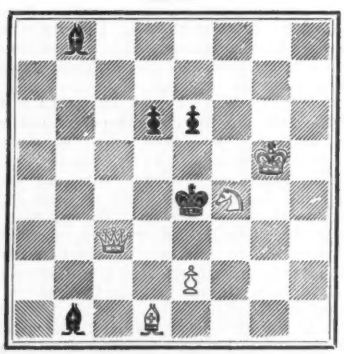
Our Chess Column.

By Mephisto.

PROBLEM No. 104.

By B. G. Laws.

Black.



White.

White to play and mate in three moves.

SOLUTIONS.

Tournay Problems, p. 266 (No. 104).

(Hesperus.)

1. Kt to B3	K to Kt5, or 3
2. Kt (K3) to Q5 (ch)	K to R4 or 6
3. B to Kt6, or Q to B sq, mate	

1.	K to Q5
2. Kt to B sq (ch)	K moves
Q mates accordingly	

(Childe Harold.)

1. B to B5	K takes P, or
2. Kt to K3 (ch)	K takes B or K4
3. Q to Kt6 or B5, mates accordingly	

1.	K to B5
2. Kt to B2	K to B6 or K4
3. Q to Kt4 or Kt5, mates accordingly	

(Tendanda via est.)

1. Kt to B8	Kt to Q4, or
2. Q takes P (ch)	K to B5
3. Kt to K6, mate	

1.	K to K6
2. B to R6 (ch)	K to K5
3. Q takes P, mate	

(Emu). (A Black Kt on K8.)

1. Q to B3, and mates accordingly

(Childe Harold.)

1. Q to K2, and mates accordingly

* This hand, one of the most interesting we have ever seen, we shall give next week.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

Berrow.—Yes; in self or sui-mate Problems, White compels Black to mate White. Problems received with thanks; you will hear from us shortly. Solutions correct.

C. Planck.—Best thanks for Problem.

C. S. P. and P. C.—Received with thanks.

E. C., Rathmines.—Two-mover correctly solved.

Henry Bristow.—All the five solutions correct.

Problem No. 103.—Correctly solved by W. Furnival, Clarence, and W.

MR. R. A. PROCTOR'S COURSE OF LECTURES.

1. LIFE OF WORLDS.
2. THE SUN.
3. THE MOON.
4. THE PLANETS.
5. COMETS.
6. THE STAR DEPTHS.

See Advt. Pages for full Syllabus.

The following arrangements are complete: the numbers in brackets referring to above list.

Town Hall, Kensington, Nov. 12, 14, 16 (1, 2, 3).
Great Hall, Tunbridge Wells, Nov. 20, 22 (4, 5).
Concert Hall, Maidstone, Nov. 19, 21, 23 (1, 2, 3).
Stockton, Nov. 26 (1).
Edinburgh, Nov. 28 (6).
Rothesay, Nov. 29 (1)
Morningside, Dec. 4 (4).
Falkirk, Dec. 5 (6).
Alexandria, Dec. 6.
Altrincham, Dec. 10 and March 11.
Carlisle, Nov. 27, 30; Dec. 3, 7 (1, 2, 3, 4).
Perry Bar, Jan. 29 (6).
King's Heath, Jan. 30 (1).
Colston Hall, Bristol, Feb. 18, 21, 25, 28; March 3, 6 (the full course).
Assembly Rooms, Cheltenham, Feb. 5, 8, 12, 15 (1, 2, 4, 6). At 3 o'clock, Feb. 5 and 12 (3, 5).
Assembly Rooms, Bath. Four Morning Lectures at 3 o'clock, Feb. 6, 9, 13, 16 (1, 3, 4, 6); two Evening, Feb. 6, 13 (2, 5).
Birkenhead, March 10.

Note.—*All communications respecting Lectures should be addressed to Mr. John Stuart, Royal Concert Hall, St. Leonards.*

Contents of No. 105.

	PAGE
Pleasant Hours with the Microscope. By H. J. Slack	267
Strange Sea Creatures. By R. A. Proctor	268
The Birth and Growth of Myth. XIX. By Edward Clodd	269
The Himalayas and the Alps. II. By Colonel Godwin Austen	270
The Amateur Electrician. (*Illus.*)	271
Curiosities of the Sub-Tropical Garden	273
The Green Sun in India. By R. A. Proctor	274
Tricycles in 1883. By J. Browning	274
Pretty Proofs of the Earth's Rotundity. By R. A. Proctor	275
Munificent Employers	276
Correspondence: Sir William Herschel—Tricycles (An Error Corrected)—Large v. Small Wheels for Tricycles—Anthropometry—The Barn Owl—Large Sun-Spots—Letters Received and Answered	277
Our Mathematical Column	279
Our Chess Column	281

SPECIAL NOTICES.

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